

WHAT IS CLAIMED IS:

1. An exhaust gas cleaning system of an internal combustion engine, the exhaust gas cleaning system comprising:

    a particulate filter disposed in an exhaust passage of the internal combustion engine;

    temperature increasing means for increasing temperature of the particulate filter;

    temperature estimating means for estimating the temperature of the particulate filter;

    particulate matter accumulation quantity estimating means for estimating a quantity of particulate matters accumulated in the particulate filter; and

    regenerating means for regenerating the particulate filter by increasing the temperature of the particulate filter to a predetermined value through an operation of the temperature increasing means and by eliminating the particulate matters accumulated in the particulate filter through combustion when the quantity of the particulate matters accumulated in the particulate filter, which is estimated by the particulate matter accumulation quantity estimating means, exceeds a predetermined value, wherein

    the regenerating means includes energy input amount determining means for determining an amount of energy inputted by the temperature increasing means in accordance with the temperature of the particulate filter estimate by the temperature estimating means.

2. The exhaust gas cleaning system of the internal combustion engine as in claim 1, wherein

the energy input amount determining means includes duty ratio determining means for determining a duty ratio between a performing period and an interrupting period of the temperature increasing operation performed by the temperature increasing means in accordance with the temperature of the particulate filter estimated by the temperature estimating means.

3. The exhaust gas cleaning system of the internal combustion engine as in claim 2, wherein

the duty ratio determining means determines a ratio of a period for performing the temperature increasing operation in a predetermined cycle period with respect to the predetermined cycle period for every predetermined cycles in accordance with the temperature of the particulate filter.

4. The exhaust gas cleaning system of the internal combustion engine as in claim 3, wherein

the particulate filter is a ceramic filter, which has an oxidation catalyst on its upstream side or supports the oxidation catalyst thereon.

5. The exhaust gas cleaning system of the internal combustion engine as in claim 4, wherein

the temperature increasing means increases a quantity of

hydrocarbon included in the exhaust gas and increases the temperature of the particulate filter by using reaction heat generated from the hydrocarbon on the oxidation catalyst.

6. The exhaust gas cleaning system of the internal combustion engine as in claim 5, wherein

the temperature increasing means increases the quantity of the hydrocarbon included in the exhaust gas by performing at least one of post-injection, retardation of fuel injection timing, restriction of an intake air flow rate and an increasing operation of an exhaust gas recirculation quantity of the exhaust gas recirculated into the intake air.

7. The exhaust gas cleaning system of the internal combustion engine as in claim 4, wherein

the duty ratio determining means sets the duty ratio to a standard value if an output of the temperature estimating means is within a predetermined range with respect to target temperature,

the duty ratio determining means decreases the duty ratio with respect to the standard value if the output of the temperature estimating means is higher than the target temperature by at least a predetermined value,

the duty ratio determining means increases the duty ratio with respect to the standard value if the output of the temperature estimating means is lower than the target temperature by at least a predetermined value,

the duty ratio determining means stops the operation of the temperature increasing means by setting the duty ratio to zero if the output of the temperature estimating means is high enough to cause damage to the particulate filter or degradation of the oxidation catalyst, and

the duty ratio determining means stops the operation of the temperature increasing means by setting the duty ratio to zero if the output of the temperature estimating means is lower than activation temperature of the oxidation catalyst.

8. The exhaust gas cleaning system of the internal combustion engine as in claim 1, wherein

the temperature estimating means estimates the temperature of the particulate filter based on an output of a temperature sensor disposed upstream or downstream of the particulate filter or based on outputs of temperature sensors disposed upstream and downstream of the particulate filter.

9. The exhaust gas cleaning system of the internal combustion engine as in claim 1, wherein

the particulate matter accumulation quantity estimating means estimates the quantity of the particulate matters accumulated in the particulate filter based on at least one of a pressure difference across the particulate filter and an operating state of the internal combustion engine.